

expenditure of blood and treasure incurred by the French Government. The military expenditure alone, he calculates, at about a yearly average of 3,000,000*l.*, or 162,000,000*l.* to the present time. To this have to be added nearly 4,000,000*l.* for some eighty fortresses and stations of all sorts required to overawe the native; about 1,800,000*l.* yearly for the civil administration; 8,000,000*l.* for caravanserais to develop the trade of the interior; 6,000,000*l.* for the ports of Bona, Philippeville, Algiers, Bougie, Oran, and one or two others; 8,000,000*l.* or 10,000,000*l.* for arsenals, canals, dredgings, and other hydraulic works, besides many other incidental expenses, the whole far exceeding any profits hitherto realised by the trade of the country. The writer dwells upon the rivalries and heart-burnings that have sprung up between the military and civil sections of the European community, which hate each other almost more intensely than both are detested by the natives. He shows that even agriculture has yielded no returns at all commensurate with the outlay incurred, and concludes that, if not actually insoluble, the problem how to found useful and profitable colonies in Africa will always remain one of the most difficult questions for the statesman and political economist.

THE *Boletín* of the Madrid Geographical Society for February gives a complete list of the recent acquisitions of Spain in West Africa. These comprise the west coast of the Sahara between Cape Bogador (29° 9' N.) and Cape Blanco (20° 45' N.), both included; in the gulf of Guinea, the coast-line stretching from the Muni River, forming the northern limit of the French possessions on the Gaboon, northwards to the Rio Campo (0° 43' to 2° 41' N.). On the Sahara coast six stations have already been established, and all points giving access to shipping will be permanently occupied. The old treaties with the chiefs on the Rio Benito have also been renewed, with a view to prevent the threatened advance of the French in that direction.

PROF. ESCRICHE, of Quadalajara, recently described, before a conference at Madrid, his project for "geographical parks." The geographical park is a public garden, reproducing on a certain scale, according to its extent, the geographical features of a country. It is a kind of map in relief; the principal towns would be represented by places surrounded by trees, the main ways of communication by winding paths; a succession of hillocks would act for the ranges of mountains, streams of water for the rivers. The clumps of trees within the network of roads would form varied pastures, in which the natural products of each locality would find its place among the flowers, and in the centre, where the towns should be, would be placed small structures, in which would be photographic views of the principal monuments, but especially the most important astronomical, geographical, historical, and artistic information with regard to the town represented.

BEFORE the last meeting of the Verein für Erdkunde, at Halle, Dr. Alfred Hettner described the United States of Columbia, their characteristics, and present condition, based on recent journeys there. After deducting the disputed territory on its borders, Columbia is half as large again as the German Empire. Its main geographical divisions are the isthmus region, the mountainous districts in the west belonging to the Andes system, and the low-lying plains of the Amazon and the Orinoco in the east. To the last belongs the Meta, which is very suitable for navigation, but is little used for that purpose; while the Magdalena, which is navigable for 640 kilometres to the Honda Cataract, belongs to the first division. The forest region, with palms in the lower and tree-ferns in the upper parts, extends up to 2000 m., the snow-line being 4600 m. in height. The Indian population, amongst which the Muysca (Tschibitscha) rank only behind the Incas and Aztecs in civilisation, was estimated in the sixteenth century at ten millions, but are said to have been reduced by the Spaniards to one-fiftieth of that number. The whole population now is given at three millions, and, according to the estimates of the Columbians themselves, 10 per cent. of these are whites, 40 Mestizos, 35 Indians, and 15 Negroes. Trade is hampered by the bad condition of the roads. Gold, silver, coffee, and hides are the chief articles of export. Railway construction, like trade, is prevented by natural difficulties and the indolent, unpractical nature of the people.

THE *Mittheilungen* of the Vienna Geographical Society for March (Band xxviii. No. 3) contains papers on the movements of the Dachstein glacier during the period 1840-84, by Dr. Simony; an account of the latest explorations in Eastern Equatorial Africa, by Dr. Le Mounier; and the first part of a paper

on the geographical work of the German Lighthouse Department in Hamburg, by Prof. Geleisch. At the meeting on March 24 Dr. Lenz read a paper on the German colonies in Eastern Africa and Oceania, which is not printed in the present number.

THE Norwegian Government have decided to dispatch an expedition this summer to Finnmarken, in the gunboat *Lougen*, for the purpose of effecting hydrographic researches and soundings along the coast. The cost is estimated at 1000*l.* The Swedish Government grant for this year to various scientific publications amounts to about 700*l.* A sum of 50*l.* has also been contributed towards the expenses of Mr. O. Nordstedt's geological researches in England and Scotland this summer.

FURTHER NOTES ON THE GEOLOGY OF PALESTINE, WITH A CONSIDERATION OF THE JORDAN VALLEY SCHEME¹

THE subject was divided as follows:—(I.) The Geological Formations of Palestine and Egypt; (II.) The Wady Arabah and the Dead Sea Basin; (III.) The Jordan Valley Canal Scheme.

Since the date of the previous communication in November, 1882, much attention had been directed to the geology and physical structure of Palestine and the adjacent regions, especially Egypt. Besides the discussions in the press relative to the suggested Jordan Valley canal, an important expedition was sent out by the Palestine Exploration Fund during the winter of 1883-84, whilst about the same time Sir J. W. Dawson visited Egypt, Suez, the Lebanon, &c., and gave his results in the *Geological Magazine*. Important information relative to the Libyan Desert has lately been published by Prof. Zittel in the "*Palæontographica*."

I. (a) *Schists, Gneiss, Granite, and Porphyries*.—Dawson describes the relations of the crystalline rocks and Nubian sandstone at the First Cataract (Assouan-Syene). A lower crystalline series, which he refers to the Laurentian, penetrated by dykes of granite and diorite, is covered in almost horizontal beds by a second crystalline series consisting mainly of porphyries permeated by dykes of felsite and basalt. Incidentally it was mentioned that, according to Russegger's map, all the Nile cataracts occur where the river is passing over such crystalline areas, whilst the more tranquil stretches of water belong to the system of his Nubian sandstone. An immense mass of crystalline rocks prevails at the great bend of the Nile which has Abu Hamed for its apex: the axis of this system occurs in the Monassir country, which is the wildest region between Assouan and Khartoum. Dawson thinks that the porphyries of Mount Hor may belong to his second series of rocks, which, in more northern countries, is represented by the Arvonian and Huronian.

(b) "*The Nubian Sandstone*."—This exhaustive division of the rocks between the Crystallines and the Upper Cretaceous may be resolved into three sections of different geological age. The Carboniferous age of the lower sandstone and overlying limestone of Wady Nash has been known for certain ever since the discoveries of Mr. Holland; but Prof. Hull's party has traced this section up the Arabah, and almost as far as the Dead Sea. The middle division is Cenomanian: it is probably in the main the original Nubian sandstone of Russegger, is widely extended in Egypt, occurs in great force at Petra, and constitutes the cliffs on the east side of the Dead Sea. There remains the Lebanon division of the *soi-disant* Nubian sandstone, and this in all probability is really newer than either of the others, being well up amongst the Cretaceous limestones, and possibly on the horizon of certain lignitiferous beds occurring at Edfou on the Nile.

(c) *Cretaceous and Nummulitic Limestones*.—The Cretaceous beds are the most important factors in Syria, whilst in Egypt those of Eocene age are much the thickest. Sir J. W. Dawson gives a section of Jebel Attâkah (partly after Le Vaillant), where the two systems are faulted together. He considers this position on the shores of the Gulf of Suez an important one as presenting an intermediate phase in both systems, thus linking the Syrian to the African types. The Cretaceous beds in Egypt are much less calcareous than in Palestine; an abundance of rock salt, gypsum, and bitumen is noted on certain horizons (Zittel). This last circumstance is noteworthy, for it will be remembered

¹ Abstract of paper read at the meeting of the Geologists' Association, on Friday, March 6, by W. H. Hudleston, M.A., F.R.S., F.G.S., &c.

that Dr. Lartet assigns to the celebrated Jebel Usdom, or Salt Mountain of the Dead Sea, a place within the Cretaceous system. But Hull's party have obtained evidence which leads them to believe that Jebel Usdom is not of Cretaceous age, but rather belongs to the marls of the Dead Sea basin. This, in fact, is almost the only point where their conclusions differ materially from those of the French geologist.

Neither in Palestine nor in Egypt is there any sharp line of demarcation between the Chalk and the Tertiary rocks, but the chalky sediments of the older Eocene follow those of the Upper Chalk with hardly any variation in their characters. And yet, according to Zittel, the palæontological boundary between the Chalk and the Eocene is clearly defined, notwithstanding the continuity of marine deposits. That author had never observed either in or above the oldest Nummulitic bed a single characteristic chalk fossil; neither did he ever find a nummulate in the chalk strata.

d. Post-nummulitic Rocks outside the area of the Dead Sea basin.—There is considerable difference of opinion as to the age of the formations that were deposited subsequent to the upheaval of the Cretaceo-nummulitic sea-bed. Those at the Isthmus of Suez are especially interesting. Dawson has named them the "Isthmian deposits," and considers them to be later than the Miocene. They occupy the highest land just north of Ismailia—thin-bedded grey limestones with vermicular holes resting on marls, sands, and clays, mostly destitute of fossils, but with some layers holding fresh-water shells, especially *Ætheria caillaulti*, which is also found in the Chalouf cutting. He concludes that a branch of the Nile discharged hereabouts, not into a marine estuary, but into a lake sometimes salt and sometimes fresh. The greater part of these "Isthmian deposits" resembled those of the terraces of the Dead Sea, presently to be considered. The period of their formation was a continental one, pliocene or post-glacial.

The subject of the recent raised beaches of the Red Sea, &c., and the probable bearing of these upon the question of the route of the Exodus was also discussed.

II. The Wady Arabah, and the Dead Sea Basin.—It was pointed out that Prof. Hull, in a lecture given at Dublin two years ago, maintained the River theory in opposition to the Lake basin theory, insisting that such a river flowed southerly from the Lebanon through the gorge of the Arabah into the Red Sea. During the pluvial period, according to this author, the overflow of the Jordanic lake was again through the Arabah in a southward direction. Doubts were thrown upon this hypothesis, since, if the present relative levels were maintained, an overflow would take place through the Pass of Jezreel, at a point only 285 feet above sea-level, leaving the watershed of the Arabah still 375 feet above such a Jordanic lake. These points were again brought out in considering the scheme for a Jordan Valley canal.

An account of the physical and geological structure of the Arabah was given, based chiefly upon Hull's summary, and on the work of the Royal Engineers in the late survey. The longitudinal section, by Major Kitchener and Sergeant-Major Armstrong, is a very fine piece of work, and sets at rest for ever the question of level in the long valley between the Red Sea and the Dead Sea, besides supplying an admirable *coup d'œil* of the eastern flank of one of the most extraordinary valleys in the world. The great Dead Sea fault recognised by Von Buch, Hitchcock, Lartet, and others was proved to pass down the Arabah, clinging to the roots of the eastern mountains. Prof. Hull's party observed it in several places, and two cross-sections are given, showing the sedimentaries faulted against the crystalline rocks. The parallel faults near the base of Mount Hor serve to repeat the phenomena with very curious and picturesque results, as is well illustrated by Prof. Hull in his book, "Mount Ser."

The physical problem so connected with these dislocations, and with the undoubted existence of the Dead Sea hollow as an independent lake-basin, dating back from a high antiquity, were partially discussed. The Dead Sea basin is separated from the southward portion of the Arabah by a watershed consisting of hard limestone covered in part by sands and gravels. This has an elevation of 660 feet, and is 45 miles from the head of the Gulf; 29 miles further north the sea-level is again reached. Hence the mass of land, through which the southern section of the Jordan Valley canal would have to be cut, is 74 miles long, with a maximum height of 660 feet, and a probable average of 250 feet.

Further proof was obtained of the independent character of the basin north of the watershed in marl deposits at an elevation of 1400 feet above the present Dead Sea level; these contain species of *Melania* and *Melanopsis* identical with some of those now existing in the fresh portions of the Jordanic basin. Hence there is little doubt that we must carry the successive lakes mentioned by Capt. Conder some stages higher than had been supposed previously. It was noted also, as bearing on this subject, that the old marls of the Jordanic lakes are not so unfossiliferous as M. Lartet would lead us to suppose. Tristram describes one species of *Melania* and two of *Melanopsis* as abundant in a semi-fossil condition in several of these old marl deposits.

Next comes the consideration of a problem which results from the adoption of the independent lake-basin theory—viz. "Since the Dead Sea has no outlet, what has become of the materials that have disappeared?" Seeing that the lateral wadies are, in the main, gorges of erosion, the difficulty is still further enhanced. That there has been some connection in past time between this curious hollow and the volcanic outbursts of the Jaulan, &c., is not improbable; indeed, it has long been suspected that an explanation of the phenomenon might, in part at least, be found in this direction. There is a partially analogous case in the meridional trough with its string of charming lakes, some fresh and some salt, which, Mr. Thompson tells us, extends along the west side of the old East African volcano, Mount Kenia: the fresh-water lake, Baringo, 3200 feet above sea-level, occupies the lowest depression of this great hollow.

III. The suggested Jordan Valley Canal.—The remainder of the paper was occupied in considering the northern section, by which the waters of the Mediterranean are to be admitted into the Jordanic basin, so as to convert it into an inland sea. If taken through the Vale of Esdraelon into the valley of the Jâlad (Jezreel), between Little Hermon and the Gilboa range, the length would be about 25 miles, starting from the port of Haifa under Mount Carmel. The height of land is 285 feet, and the mean depth of the cutting to the water-surface would be about 150 feet, without including the depth of the canal itself. The surface of the Vale of Esdraelon consists mainly of Post-Tertiary loams, &c., below which hard limestone, and possibly basalt, would have to be encountered. The alternative of a railway was discussed.

CHINESE INSECT-WHITE WAX

A PARLIAMENTARY paper which has recently been published (China, No. 2, 1885) contains a report of a journey through Central Sze-chu'an, which was made by Mr. Hosie, consular agent at Chung-king, chiefly for the purpose of collecting information on the subject of insect white wax, specimens of the insect wax-trees, and forms of the wax product, at the request of Sir Joseph Hooker. The report describes the country traversed, its trade and trading capabilities, and such information as was attainable on any commercial product of the district; but the portion relating to insect white wax is the most interesting part of the paper.

"Insect tree" is the name given by the Chinese in the extreme west of Sze-chu'an to what is probably the *Ligustrum lucidum* of botanists. The point will doubtless be decided at Kew by the specimens which Mr. Hosie has sent home. It is also called the winter-green or evergreen tree; while in the east of the province it is known as the "crackling flea tree," owing, it is said, to the sputtering of the wood when burned. It is an evergreen, with leaves which spring in pairs from the branches. They are thick, dark green, glossy, ovate, and pointed. In the end of May or beginning of June the tree bears clusters of small white flowers, which give place to small seeds of a dark blue colour. In the month of May, 1883, Mr. Hosie found attached to the bark of the boughs and twigs numerous brown pea-shaped excrescences or galls, in various stages of development. In the earlier stages they looked like minute univalves clinging to the bark. The larger galls were readily detachable, and, when opened, presented either a whitey-brown pulpy mass, or a crowd of minute animals, whose movements were only just perceptible to the naked eye. Last year an opportunity of examining these galls and their contents with some minuteness in the chief wax-producing locality in the province presented itself. They are very brittle, and there was found, on opening them, a swarm of brown creatures, like minute lice, each with six legs and a pair of club antennæ, crawling about. The great majority of the galls also contained either a small